

## Mollusca from the Continental Shelf, Eastern Otago.

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### Abstract.

A hard-bottom fauna from off the Continental shelf of Eastern Otago is named the *Chlamys delicatula-Fusitriton* community. It is compared with a similar North West American hard bottom community. The following new species of mollusca are described: *Venus blacki*, *Pachymelon (Palomelon) smithi*, and *Panopea smithae*; also a new Pliocene ancestor to the latter, *Panopea wangannica*.

The material was obtained by Captain A. Black, of the trawler "Tairoa," in from fifty to seventy fathoms along the continental shelf of Eastern Otago, from the Nuggets north to the mouth of the Waitaki River.

I am much indebted to Captain Black for his excellent work in collecting the material and to the late Mrs. J. G. Smith and Mr. Smith for the care they have taken with the preparation of the specimens, the accompanying notes and the generous gift of type specimens and representative series for the Museum collections.

An interesting outcome of study of this collection is the revealed presence of an extensive hard bottom community occupying the outer edge of the eastern Otago shelf. The dominants of this community, *Chlamys delicatula* and *Fusitriton laudandum*, were previously considered to rank amongst our very rare molluscs.

This community immediately recalls a northern hemisphere analogous one in the *Strongylocentrotus-Argobuccinum* formation from the vicinity of Puget Sound, Washington (Shelford and Towler, 1925). The dominants there are the green sea-urchin *Strongylocentrotus drobachiensis* and the mollusc *Fusitriton oregonensis* (i.e., *Argobuccinum* of Shelford and Towler). Other dominants are a starfish, crab, several barnacles, two scallops, *Chlamys hindsii* and *C. hercius*, and a gasteropod, *Calliostoma costatum*. Among the sub-dominants are the mussel *Modiolus modiolus* and the brachiopod *Terebratalia transversa*.

The Washington community is stated by Shelford and Towler to be best developed on rock bottom, but the same association of animals occurs on shelly and even hard-sand bottom. It ranges to a depth of at least 150 metres, but the upper limit is not clearly stated. Algae is of little significance and occurs only in places.

Except that sea-urchins are minor inclusions in the Otago community there is an almost exact parallel between the faunal composition of the New Zealand and Washington communities.

The Otago community, which I here designate the *Chlamys delicatula-Fusitriton* community, develops in from 50 to 70 fathoms on a hard-sand, shelly or gravel bottom under the influence of strong tidal

currents and is stenothermally confined to between  $46^{\circ}$  S. and  $54^{\circ}42'$  S. with its optimum development in the vicinity of  $46^{\circ}$  S. It would seem that *Fusitriton* loses dominance quickly to the south, but does occur sporadically far to the north; of the northern Recent limit for *delicatula*, which is Otago, *Fusitriton lundatum* has been trawled in 40-50 fathoms off Cape Campbell, Marlborough, and I have a specimen from the Ninety Mile Beach, Northland. The furthest south record for *lundatum* is Auckland Islands (Cape Expedition).

At the southern extremity of the *delicatula* range the dominance is shared with the venerid *olive* *Taraxa mowsoni*, and this may be termed the *Chlamys delicatula-Taraxa* community.

A more precise evaluation would be formation and association respectively for these communities, but the term formation conflicts with the geological usage of that term and causes confusion, especially in paleogeological work, so the non-committal term community is preferred for the present.

### The *Chlamys delicatula-Fusitriton* Community

#### a. Dominants

*Chlamys* (*Zygochlamys*) *delicatula* (Hutton), *Fusitriton lundatum* Finlay, *Astraea heliographum* (Martyn), *Alicia* *swainsoni* Marwick, *Venericardia purpurata* Deshayes, *Atrina zelandica* (Gray), *Modiolus oreolatus* (Gould), *Arca novaezelandiae* Smith (Moll.), and *Neobornia (Pentacaria) Dech.* (Brach.).

#### b. Subdominants

*Longinocma elongata* Q. & G., *Lima zelandica* Sowerby, *Gastrea charlotteae* Finlay, *Glycymeris laticostata* Q. & G., *Arachnoicium tumidum* (Dunker), *Verrucella furfieldae* Powell, *Atrichia calva* Powell, *Panoplia sulcata* n. sp., *Chlamys radiatus* Hutton, *C. setosus* Finlay (Moll.), and *Percebellia sanguinea* Leach (Brach.).

#### c. Secondary species

*Predalioa mirabilis* Finlay, *Charonia capax eulionides* Finlay, *Venerator typus* (Martyn), *V. pellicida forsteriana* Dell, *V. punctulata angula* Powell, *V. forcaurana* Dell, *V. blacki* n. sp., *V. cunninghami pagoda* Oliver<sup>4</sup>, *Cardita notiana* Finlay, *Monda zelandica* (Gray), *Pachymelon (Palomelon) smithi* n. sp., *Austrofulcus glans agrestis* Finlay, *Mauriculus roseus* Q. & G., *Maoricrypta (Zeacrypta) mowsoni* (Lesson), *Cominella (Buccinina) otakawa* Powell, and *Xenophanthe (Xenophana) sulcata* Iredale<sup>4</sup> (Moll.).

Mr. J. G. Smith mentioned the occasional presence of sea-urchins in the trawls, but I have not seen material. From other dredgings in the vicinity I have *Pseudarchinus huttoni* Benham and *Gastriochinus umbraculatus* Hutton.

<sup>4</sup> These two species are uncommon in the collection and probably belong to a more shallow fine textured sandy bottom. Finlay recorded both from 20 to 30 fathoms off Otago Heads and off Waitotahi.

Owing to the large mesh of the commercial trawls there is an almost complete absence of the smaller and micro species in the collection. However, several bottom samples in from 50-70 fathoms off Otago Heads, obtained by a naturalists' dredge, reveal a rich microfauna and the following quite abundant small molluscs: *Microtenchus sanguineus caelatus* (Hutton), *Thoristella chathamensis benthicola* Finlay, and *Myadora novaezelandiae* Smith.

### ***Chlamys radiata* (Hutton)**

Five examples in the collection are large and three of them match Stewart Island topotypes in every respect. That is, they are finely and evenly scaly-ribbed and are of either uniform reddish-purple or uniformly orange colour. These are the only colours encountered at Stewart Island. The remaining two Otago specimens have slightly coarser and more sparse ribs and a diffused pattern of reddish-brown on a buff to pinkish-white ground.

I have not seen typical *radiata* from north of Otago. Cook Strait examples are mostly the smaller vari-coloured more spiny and sparsely ribbed *gemmulata*. A small vari-coloured *radiata* is found at Cook Strait, but it never reaches the size of adult topotypes. Hybridization between *radiata* and *gemmulata* seems to occur. However, a form of equal size to fully adult topotypes of *radiata* occurs ca. 70 fathoms off Kapiti Island. These were dredged in great numbers by the R.R.S. Discovery II, but only odd valves were taken and it may be that these shells are from a fossil deposit marking a cool phase in the post-Pleistocene, contemporary with the Cape Campbell, 70 fathoms deposits that yielded *Chlamys delicatula* and *Eucominia marlboroughensis* (Powell, 1946, Rec. Auck. Inst. Mus. 3 (2), p. 144).

The Kapiti shells, however, are much more finely ribbed than any other *radiata* form and merit subspecific designation. The following table is based upon a radial rib count per centimeter at a point 30 mm. from the umbo in each case.

	Left valve.	Right valve.
<i>radiata</i> (Topotypes, Stewart Island)	20-24	18-22
" Otago Heads (typical)	20-23	15-20
" Otago Heads ( <i>gemmulata</i> pattern)	19-20	16-16
" Kai Iwi (Up Pliocene)	21-25	20-23
<i>radiata</i> N. subsp.? (Kapiti Island)	25-35	22-28
<i>gemmulata</i> (Topotypes? Cook Strait)	14-23	14-20
<i>consociata</i> Hauraki Gulf, 20 fath.	18-24	16-20

Hauraki Gulf examples are vari-coloured and small. They are covered by Smith's name *consociata* and may be regarded as a northern subspecies of *radiata* rather than a form of the coarser sculptured *gemmulata*.

My suggested arrangement of these shells is as follows:

*radiata*: Forsterian, with its normal limit North Otago; Upper Pliocene but never reaching the maximum adult size of Recent shells.

*radiata consociata*: Hauraki Gulf and Northland.

*gemmulata*: Cook Strait and as an influence to the south.

***Chlamys (Zygochlamys) delicatula* (Hutton)**

1873.—*Pecten delicatulus* Hutton Cat. Tert. Moll. p. 30.

1873.—*Pecten difflua* Hutton Cat. Tert. Moll. p. 31.

1916.—*Chlamys subantarctica* Hedley Aust. Ant. Exped. Ser. C.4 (1), Moll. p. 23.

1924.—*Chlamys cambellicus* Odhner, N.Z. Moll. Pap. Mort. Pacific Exped. p. 61.

There seems little doubt that the names covered in the above synonymy refer to one species with a time range from Nukumaruan (Middle Pliocene) to the present and a Recent geographic range from Macquarie Island 54°42' S. to Eastern Otago, 46° S.

**Genus PANOPEA Ménéard de la Groye, 1807.**

The bringing together of material from a wide range of localities has revealed the presence of a second Recent *Panopea* in New Zealand waters and a new species ancestral to it from the Pliocene.

The two Recent members are easily separable by the depth of the pallial sinus, which feature is coupled with a distinctive shell outline for each species. In concise terms, *zelandica* has a shallow sinus which extends only half the distance from the posterior end to the umbo and the shell outline is rectangular, broadly rounded anteriorly but square-ended posteriorly. The new Recent species has an extremely deep sinus which extends to beneath the umbo and the shell outline is more or less rhomboidal, cut away at the lower anterior margin and obliquely protractively arcuate at the posterior end. The Pliocene new species has a very deep sinus also, but coupled with a further distinctive shell shape. The posterior gape is considerably greater for the Recent new species which, on this evidence, coupled with that of the very deep sinus, is indicative of a much deeper burrowing habit than for *zelandica*.

The distribution of the two Recent species presents a confused picture:

- (1) Neither species is stenothermic—*zelandica* is more commonly found in northern shallow waters, and the new species in deeper southern waters, 20-70 fathoms, Eastern Otago, Stewart Island and Chatham Islands. However, there are *zelandica* records (shallow water) from The Spit, Otago Heads, and Stewart Island as well as n. sp. records from the Hauraki Gulf in 26-30 fathoms.
- (2) Both *zelandica* and a species ancestral to the Recent deep-sinused one occur in the Wanganui series, i.e., *zelandica* typical from Landguard Bluff and Castlecliff and a deep sinused species from Landguard Bluff, Castlecliff, Kai Iwi, Nukumarua sands, Waipipi and Waihi Beach, Hawera. I am not certain about the nature of the sinus in the latter two occurrences, since the material is too fragile to allow excavation, but externally they conform with the Castlecliffian deep sinused species. Specimens of *Panopea orbita* from Mount Harris (Otaian-Hutchinsonian) mid-upper Oligocene, are deep sinused.

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Finlay (1926, T.N.Z.I. 57, p. 473) was incorrect in adopting the vernacular rendering, i.e., "*Panope*," as the genus name. The original proposition (April, 1807) was *Panopea*.

- (3) The habitat of *zelandica* is coastal in shallow-water in a substratum of fine textured, often micaceous sand. The 60 fathoms Hick's Bay record is based upon an odd valve that may have washed down from shallow water.

The true habitat of the new species is problematic. Dead shells, often with conjoined valves, are commonly dredged from shelly beds in Foveaux Strait and off the Eastern Otago continental shelf. Also the two Hauraki Gulf records are based upon odd valves dredged from coarse shelly deposits. This would seem to confirm that the new species lives buried deeply in shelly deposits, but on the other hand it may be either a mud dweller from an adjacent soft bottom area or it may occupy a gritty transitional zone between the hard and soft bottoms. However, the fact that many of the Otago shells were conjoined pairs indicates that they had not been transported far if at all from the shelly deposits from which the shells had been dredged.

- (4) The Pliocene records only serve to confuse the issue still further. Admittedly the Pliocene deep-sinused species is not specifically identical with the Recent new species, so it is not essential that it should have lived under the same ecological conditions.

Pliocene records of *zelandica* confirm the habitat preference shown by the Recent occurrences of that species. It is found in the shallow-water loose yellow quartz mica sands at Landguard Bluff, that is "LG. 1" of Fleming (1947 Trans. Roy. Soc. N.Z., 76, p. 324), and also at Castlecliff in Fleming's *Zethalia-Amphidesma* Sands, "CU. 5," which is a shallow water deposit also, of loose, coarse, current-bedded micaceous sand.

The Pliocene records of the deep-sinused species, however, are conflicting, especially as all the following records are of conjoined specimens that must have lived in or near to the substratum in which they were buried. The occurrences are (a) Landguard Bluff, "LG. 1," in loose yellow quartz mica sands, (b) Castlecliff, probably "CU. 2," muddy medium micaceous sandstone, (c) Kai Iwi, "CL. 10d," muddy sandstone, (d) Nukumaru Brown Sands, "NU. 2," loose fine to coarse sands of shallow water occurrence, (e) Waipipi, mudstone, and (f) Waihi Beach, Hawera, mudstone.

- (5) From the above it will be noted that *zelandica* is always associated with a fine textured sandy bottom in shallow water on an open coast, that the deep-sinused Recent species favours deep water, coarse shelly deposits, and that the Pliocene deep-sinused species apparently ranged through sandy and muddy substrata and occurred from shallow to deep water.
- (6) Notwithstanding the confused ecological data, the fact remains that two easily recognised species of Recent *Panopca* occur in New Zealand waters and that a Pliocene one requires nomination as a third species ancestral to the deep-sinused Recent one. The fact is established that all specimens examined have either a shallow or a deep pallial sinus, and that the latter occurs quite irrespective of depth or bottom materials. An intermediate development of the sinus is nowhere evident.

- (7) Evidently the shallow sinus is a late development, since the earliest appearance of this feature is in *zelandica* from Castlecliff. That species may represent a divergence from the main line to fit a definite ecological niche, i.e., a fine textured sandy substratum in shallow water off an ocean beach.

### *Panopea zelandica* Quoy & Gaimard

1835.—*Panopaea zelandica* Q. & G. Voy. Astrol. 3, p. 547, pl. 83, f. 7-9.

1843.—*Panopea solandri* Gray, Dieff. N.Z., p. 255.

1913.—*Panopea zelandica*: Suter, Man. N.Z. Moll. p. 1013, pl. 61, figs. 10, a.

1926.—*Panope zelandica*: Finlay, Trans. N.Z. Inst. 57, p. 473.

1946.—*Panope zelandica*: Powell, Shellfish of N.Z. 2nd ed., pl. 11, f. 22.

*Types*: New Zealand; Mus. Hist. Nat., Paris (*zelandica*); Tauranga, British Mus. (*solandri*).

The exact locality of Quoy and Gaimard's *zelandica* was not stated but it was most likely Tasman Bay, Nelson. Their figures do not show the sinus, but the outline of the valves coincides with *zelandica* of equivalent small size, i.e., 73 x 52 mm. Only individuals of larger size than this show the medial flattening of the posterior end. The dorsal view shows a degree of inflation more in accord with *zelandica* than with the deep-sinused species. Gray's *solandri* from Tauranga is undoubtedly a synonym of *zelandica*.

Length.	Height.	Inflation.	Anterior gape.	Sinus depth.	Locality.
128.0 mm.	79.0 mm.	—	—	41.0 mm.	C
121.0 mm.	68.5 mm.	52.0 mm.	38.0 mm.	36.0 mm.	R
92.5 mm.	57.0 mm.	37.0 mm.	26.0 mm.	36.0 mm.	O
65.0 mm.	37.5 mm.	23.5 mm.	17.0 mm.	26.0 mm.	M

(C = Collingwood Beach, West Nelson; R = Rona Bay, Wellington; O = Opotiki; and M = Mt. Maunganui, Bay of Plenty.)

*Localities*: Tokerau Beach, Doubtless Bay (A.W.B.P., Jan., 1950); Cheltenham Beach (W. H. Webster) and Takapuna Beach, Auckland (C. R. Laws); Mt. Maunganui and Opotiki, Bay of Plenty; off Hick's Bay, 60 fath. (S. Voss); Rona Bay and Lowry Bay, Wellington Harbour; Collingwood Beach, West Nelson (A.W.B.P.); New Brighton, Canterbury; Warrington, Otago (Finlay coll. Auck. Mus.); The Spit, Otago Heads (C. R. Laws coll. Auck. Mus.); Stewart Island (Auck. Mus.).

*Note*.—The 60 fathoms Hick's Bay record is a single valve that may have washed down from shallow water. I know of no other deep water records for *zelandica*.

### *Panopea smithae* n. sp. Pl. 7, fig. 5 and text figs. 4-6.

Shell large, solid, inaequilateral, gaping at both ends, but much more posteriorly. Outline distinctly rhomboidal, anterior end the shorter, narrowly rounded above and obliquely cut away towards the ventral margin; posterior end broadly rounded to flattened and inclined posteriorly.

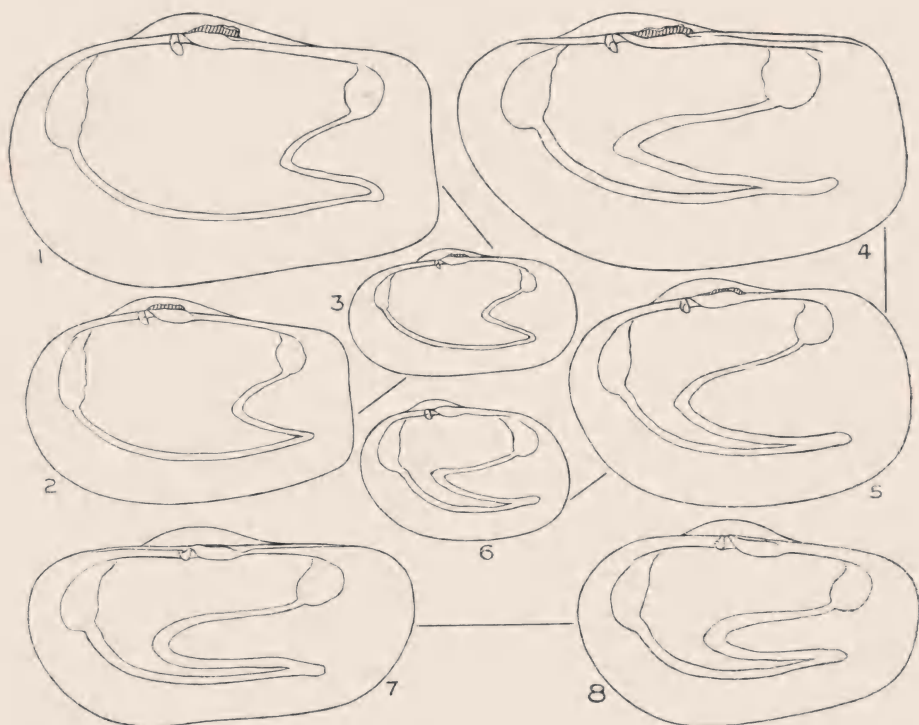
Compared with *zelandica* the new species is more solid, is of rhomboidal rather than rectangular outline, has a much deeper pallial sinus which terminates level with the umbo and a greater posterior gape of the valves. Hinge and ligament are similar in both species, but the posterior adductor scar is relatively larger and more circular in *smithae*.

Length.	Height.	Inflat: on.	Posterior gape.	Sinus depth.	Locality.
130.0 mm.	76.0 mm.	—	—	79.0 mm.	S
112.0 mm.	74.5 mm.	49.0 mm.	42.0 mm.	63.0 mm.	O
105.0 mm.	67.0 mm.	50.0 mm.	43.0 mm.	65.0 mm.	O(H)
94.0 mm.	63.0 mm.	42.0 mm.	37.0 mm.	57.0 mm.	O
60.5 mm.	41.0 mm.	—	—	35.0 mm.	O

(S = Stewart Island; O = off Eastern Otago ca. 70 fathoms; H = holotype.)

*Localities:* Off Eastern Otago ca. 70 fathoms (type); Stewart Island (Mrs. R. H. Harrison); Foveaux Strait, 17 fathoms (Finlay coll. Auck. Mus.); Owenga, Chatham Islands (A.W.B.P. Auck. Mus.); Wellington Harbour dredgings; Lowry Bay and Lyall Bay, Wellington (Dominion Mus.); (Since the above was written Mr. R. K. Dell has forwarded to me the *Panopea* material in the Dominion Museum collection. Both *zelandica* and *smithae* occur in two of the dredgings, but there is no indication of the bottom materials. Following is a note of the localities and the species represented: Wellington Harbour (suction dredgings), 3 *smithae* and 2 *zelandica*; Falcon Shoal, 6 fathoms, Wellington Harbour, 8 *smithae* and 2 *zelandica*; Lyall Bay (cast ashore), 2 *smithae*.); 1 mile off Cape Rodney, Hauraki Gulf, 26 fathoms (one valve, Govt. Trawler "Ikaterere" Stn. 30);  $\frac{3}{4}$  mile off Wellington Head, Great Barrier Island, 30 fathoms (one valve "Ikaterere" Stn. 35).

All the above records are from a coarse shelly bottom.



*Panopea zelandica* Q. & G. Fig 1, Collingwood; Fig. 2, Opotiki; Fig. 3, Mount Maunganui. *Panopea smithae* n. sp. Fig. 4, Stewart Island; Fig. 5, 70 fathoms, Eastern Otago; Fig. 6, 72 fathoms, Otago Heads. *Panopea wanganniica* n. sp. Fig. 7, Holotype, Kai Iwi, Upper Pliocene; Fig. 8, Nukumarau, Middle Pliocene.

(All figures to uniform scale of 2-5th natural size.)

**Panopea wanganuica** n. sp. Pl. 7, fig. 6 and text figs. 7, 8.

Shell large, relatively thin, inaequilateral, gaping at both ends but very much more posteriorly. Outline ovate-cylindrical, relatively straight dorsally and ventrally and with shell height slightly greater towards the anterior end. Both ends narrowly rounded above middle height and arcuately cut away in broadly rounded sweeps to the flattened to slightly concave ventral margin. Pallial sinus very deep, extending to directly under, or even a little anterior to, the umbo.

Compared with *smithae*, the Pliocene species differs at sight in having both ends converging to the ventral margin. The posterior adductor scar is intermediate in size between that of *smithae* and that of *zelandica*. A feature common to both *smithae* and *wanganuica* is the very straight hinge line.

Length.	Height.	Inflation.	Posterior gape.	Sinus depth.	Locality.
110.0 mm.	57.5 mm.	42.0 mm.	41.0 mm.	72.0 mm.	K(H)
98.5 mm.	60.5 mm.	42.0 mm.	38.0 mm.	62.0 mm.	N
78.0 mm.	41.0 mm.	30.5 mm.	26.0 mm.	53.0 mm.	L

(K = Kai Iwi; N = Nukumarū; L = Landguard Bluff; H = holotype.)

*Holotype*: Auckland Museum.

*Localities*: Landguard Bluff, LG1 (A.W.B.P. coll.); Kai Iwi, CL10d (holotype); Wanganui Castlecliffian (Upper Pliocene) and tentatively Nukumarū Brown Sands, NU2 (N.Z. Geol. Surv.); Nukumaruan (middle Pliocene); Waipipi and Waihi Beach, Hawera, Waitotaran (lower Pliocene).

The Nukumarū specimen is relatively shorter and much higher towards the anterior end, resulting in proportions nearer to those of *zelandica*, but the sinus is very deep and the hinge line straight as in *wanganuica*.

The pallial sinus is not visible in either the Waipipi or Waihi, Hawera, specimens (N.Z. Geol. Surv. coll.), so their status is undetermined. Both are nearer to *wanganuica* in shape, but are relatively shorter.

**Venustas blacki** n. sp. Pl. 7, figs 3 and 4.

Shell conical, moderately solid, imperforate, of flesh to bright pink colour, sculptured with numerous regularly granulated spiral ribs and an interstitial pattern of from two to five crisp spiral threads. On the base the primary spirals are narrower, weaker and wider-spaced and the interstitial threads rather more prominent, but margining the umbilical callus and there are two closely spaced granulated spirals equal in strength to those of the spire-whorls. The spirals on the upper surface are dark pink with the granules pale pink to almost white. The smooth basal spirals have an alternation of pale and dark pink which resolves into an irregular radial pattern. The two granulated spirals bordering the umbilical callus have the granules pale on a dark pink ground as on the spire. The primary spirals are three on the second and third post-nuclear whorls, five on the ante-penultimate and eight on the penultimate. There are eight or nine smooth primary spirals on the base.

Height, 41.0 mm.; diameter, 41.0 mm. Spire angle, 81°.

*Holotype*: Auckland Museum, presented by the late Mrs. J. G. Smith.



*Locality*: Eastern Otago, ca. 70 fathoms (Holotype and paratype only).

The species seems to be nearest to Tomlin's *megaloprepes* (1948, B.A.N.Z. Ant. Res. Exped. vol. 5 (5), p. 225) from Macquarie Island which has the same kind of basal sculpture, including the paired stronger spirals margining the umbilical callus.

**Pachymelon (Palomelon) smithi** n. sp. Pl. 7, figs. 1 and 2.

Shell large, solid, narrowly fusiform, sculptured with vertical axial folds, 14-15 per whorl, which reach from suture to suture but are obsolete on the last whorl, strong within the aperture but not fully visible from without. Spire two-thirds height of aperture. Post-nuclear whorls six; nucleus eroded. Columella straight with four very oblique plaits. Basal notch moderately broad and very shallow. Colour uniformly pinkish-buff without colour markings.

Height, 118.0 mm.; diameter, 45.5 mm.

*Holotype*: Auckland Museum, presented by Mr. J. G. Smith.

*Locality*: Eastern Otago, ca. 70 fathoms (The holotype, a dead shell, only).

The species is nearest allied to the Chatham Islands *wilsonae* (Powell, 1933, Rec. Auck. Inst. Mus. 1 (4), p. 204) from which it differs in its narrower outline, taller spire, much less prominent columellar plaits, and absence of axials from the whole of the body-whorl. The absence of colour pattern in the holotype may not be a constant feature.

**Iredalina mirabilis** Finlay.

1926.—*Iredalina mirabilis* Finlay Proc. Malac. Soc. 17, pp. 59-62.

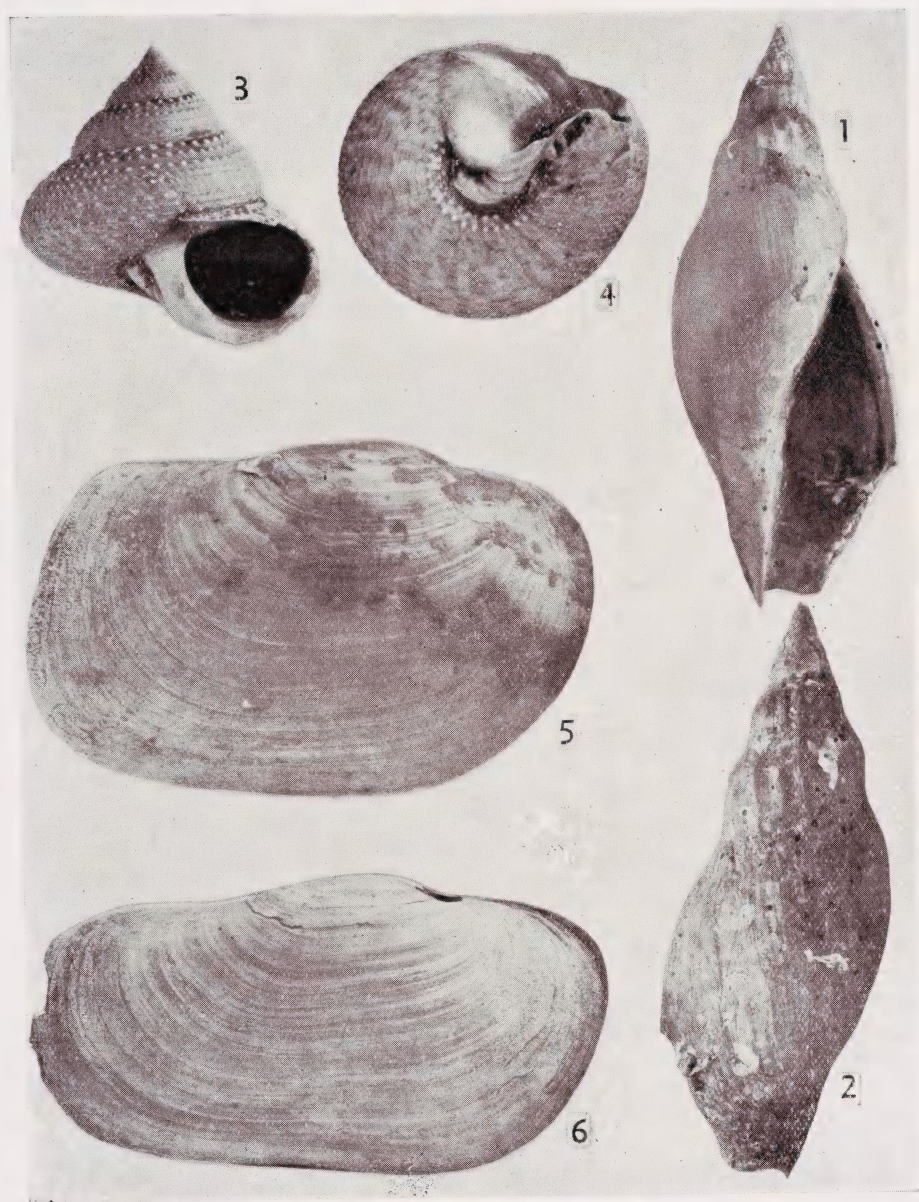
The holotype, which until the present has been unique, was trawled in 40 fathoms off Otago Heads.

Four dead shells in the present collection add a little to our knowledge of the species, which is shown to have a smooth glazed surface and pale salmon coloration without colour pattern. The protoconch is small, conical and symmetrically coiled, but is not well enough preserved in any of the specimens to furnish any further observations.

Finlay compared his genus with the plaitless Kerguelen Island *Provocator* and *Guivillea*, but favoured derivation of *Iredalina* from early Ericusoid stock. This Australian genus, *Ericusa*, however, has well developed plaits, a relatively large nucleus with an oblique apex and a distinctive colour pattern.

My impression is that *Iredalina* is much nearer to *Provocator*, not only on account of the plaitless pillar but also the glazed surface without colour pattern, the small erect nucleus and the deeply retrocurrent trend of the outer lip to the suture.

The holotype of *Iredalina mirabilis* is evidently abnormally elongated. The present specimens have a shorter spire and relatively more inflated body-whorl: i.e., height, 101 mm.; diameter, 42 mm.



Figs. 1 & 2: *Pachymelon (Palomelon) smithi* n. sp. (Holotype).

Figs. 3 & 4: *Venustas blacki* n. sp. (Holotype).

Fig. 5: *Panopea smithae* n. sp. (Holotype).

Fig. 6: *Panopea wangamuiica* n. sp. (Holotype).